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Claims:

1. A membrane structure, comprising:
a membrane whose position is to be controlled;
5 a supporting frame;
a plurality of threads connecting the membrane to the supporting frame;
and
an electrostrictive polymer actuator integrated into at least one thread,
the electrostrictive polymer actuator having a longitudinal axis that is
10 substantially aligned with the axis of the thread;
wherein the electrostrictive polymer actuator displaces along its
longitudinal axis, thereby affecting movement of the membrane surface.
2. The structure of claim 1, wherein the electrostrictive polymer
15 actuator contracts.
3. The structure of claim 1, wherein the electrostrictive polymer
actuator expands.
- 20 4. The structure of claim 1, wherein displacement of the
electrostrictive polymer actuator affects tension in the thread.
5. The structure of claim 4, wherein tension in the thread affects
tension of the membrane.

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6. The structure of claim 1, wherein the electrostrictive polymer actuator comprises:

an electrostrictive polymer having a tailorable Poisson's ratio, wherein the electrostrictive polymer is electroded on its upper and lower surfaces;

5 an upper material layer bonded to the upper electroded surface of the electrostrictive polymer, wherein the electroded electrostrictive polymer and upper material layer form a bonded assembly, wherein the bonded assembly is rolled into a roll having two ends, and further wherein entire adjacent surfaces within the roll contact one another; and

10 a cap affixed to each end of the roll.

7. The structure of claim 6, wherein the electrostrictive polymer comprises an electrostrictive graft elastomer comprising a backbone molecule which is a non-crystallizable, flexible macromolecular chain, and a grafted
15 polymer forming polar graft moieties with backbone molecules, the polar graft moieties having been rotated by an applied electric field and sustained in the rotated state until the electric field is removed.

8. The structure of claim 6, wherein the electrostrictive polymer is
20 electroded with a conductive polymer.

9. The structure of claim 6, wherein the electrostrictive polymer is electroded with a soft metal.

25 10. The structure of claim 6, wherein the electrostrictive polymer is electroded with materials selecting from the group consisting of polypyrrole, polyaniline, and gold.

11. The structure of claim 6, wherein the electrostrictive polymer is
30 electroded with single surface electrodes.

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12. The structure of claim 6, wherein the electrostrictive polymer is electroded with interdigitated electrodes.

13. The structure of claim 6, wherein the upper material layer is
5 selected from the group consisting of insulator and electrostrictive polymer.

14. The structure of claim 6, wherein the upper material layer is an electrostrictive polymer having a tailorable Poisson's ratio.

10 15. The structure of claim 6, wherein the cap is selected from the group consisting of plastic and insulated metal.

16. The structure of claim 6, wherein the cap is affixed to the end of each roll by means selected from the group consisting of chemical and
15 mechanical.

17. The structure of claim 6, wherein the cap is affixed to the end of each roll by epoxy bonding.

20 18. The structure of claim 6, wherein the thread is affixed to the cap by mechanical means.

19. An electrostrictive polymer actuator, comprising:
an electrostrictive polymer having a tailorable Poisson's ratio, wherein
25 the electrostrictive polymer is electroded on its upper and lower surfaces;
an upper material layer bonded to the upper electroded surface of the electrostrictive polymer, wherein the electroded electrostrictive polymer and upper material layer form a bonded assembly, wherein the bonded assembly is rolled into a roll having two ends, and further wherein entire adjacent surfaces
30 within the roll contact one another; and
a cap affixed to each end of the roll.

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20. The structure of claim 19, wherein the electrostrictive polymer comprises an electrostrictive graft elastomer comprising a backbone molecule which is a non-crystallizable, flexible macromolecular chain, and a grafted polymer forming polar graft moieties with backbone molecules, the polar graft moieties having been rotated by an applied electric field and sustained in the rotated state until the electric field is removed.

21. The structure of claim 19, wherein the electrostrictive polymer is electroded with a conductive polymer.

22. The structure of claim 19, wherein the electrostrictive polymer is electroded with a soft metal.

23. The structure of claim 19, wherein the electrostrictive polymer is electroded with materials selecting from the group consisting of polypyrrole, polyaniline, and gold.

24. The structure of claim 19, wherein the electrostrictive polymer is electroded with single surface electrodes.

25. The structure of claim 19, wherein the electrostrictive polymer is electroded with interdigitated electrodes.

26. The structure of claim 19, wherein the upper material layer is selected from the group consisting of insulator and electrostrictive polymer.

27. The structure of claim 19, wherein the upper material layer is an electrostrictive polymer having a tailorable Poisson's ratio.

28. The structure of claim 19, wherein the cap is selected from the group consisting of plastic and insulated metal.

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29. The structure of claim 19, wherein the cap is affixed to the end of each roll by means selected from the group consisting of chemical and mechanical.

5 30. The structure of claim 19, wherein the cap is affixed to the end of
each roll by epoxy bonding.

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